

TAXONOMIC AND NOMENCLATURAL NOTES ON THE
GENUS RHUS (ANACARDIACEAE)¹

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THERE IS MUCH DISAGREEMENT in regard to the taxonomy of *Rhus* L. in the recent regional floras of North America. While many authors accept Engler's delimitation of the genus and recognize only *Cotinus* Mill. and *Metopium* P. Br. as segregates of *Rhus*, some taxonomists follow Barkley (1937, 1940) either completely or partly in regarding "*Schmaltzia* Desv. [ex Small] emend. Barkley & Reed" and/or *Toxicodendron* Mill. as distinct genera. The interpretation of these groups either as subdivisions of *Rhus* or as separate genera certainly is a matter of personal opinion which would hardly require any additional investigations and discussion if the differences in interpretation only pertained to different evaluations of accurately established facts (characters). However, in the course of surveying the genera of Anacardiaceae in the southeastern United States (see Jour. Arnold Arb. 43: 359-375. 1962) and examining the herbarium material of *Rhus*, the author found that at least some of the supposed generic differences between *Rhus* and segregated genera are based on incomplete or inaccurate observations. It was therefore thought necessary to check the taxonomic values of differential characters which have been considered basic for the generic segregation of "*Schmaltzia*" and *Toxicodendron* from *Rhus* by examination of more extensive herbarium material and by consulting the literature. A discussion of the results of this effort, the delimitation of the genus *Rhus* L., comprises the first part of the present article; the second part is devoted to the correct name for the group of species segregated as "*Schmaltzia* Desv."

THE GENERIC LIMITS OF RHUS

The genus *Rhus* as established by Linnaeus in 1753 (Sp. Pl. 1: 265-267) and in 1754 (Gen. Pl. ed. 5. 129) comprised *Cotinus*, *Toxicodendron*, and *Rhus* of Tournefort (Inst. Rei Herb. ed. 2. 1: 610, 611; 3: pls. 380, 381). In 1762, Linnaeus (Sp. Pl. ed. 2. 381) also included *Metopium* P. Br. (Civ. Nat. Hist. Jamaica, 177. 1756) in the genus, as *R. Metopium*. Miller (Gard. Dict. Abridg. ed. 4. 1754) first treated the Tournefort genera as distinct, but, in 1768 (Gard. Dict. ed. 8), included *Cotinus*, as well as Browne's *Metopium*, in *Rhus*, retaining *Toxicodendron* as a distinct

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genus. Since that time *Cotinus*, *Metopium*, and *Toxicodendron* have been treated by different authors either as subdivisions (sections or subgenera) of *Rhus* or as distinct genera.

Besides these taxa, smaller groups of species of *Rhus* also have been segregated. Thus, in 1819, Rafinesque (p. 357) established the genus *Lobadium*, based on *Rhus aromatica* Ait., distinguishing it from *Rhus* on the basis of its precocious, spikelike inflorescences and a supposed difference in the floral structure, the conspicuous lobes of the nectariferous disc in this species being interpreted by him as "glandular bilobed appendages to the petals." Rafinesque's genus was afterwards recognized as distinct from *Rhus* by several authors (e.g., Greene, 1905; Britton & Brown, 1913; Small, 1933) under its earlier provisional name *Schmaltzia* Desv. In 1838, Torrey and Gray (p. 220) published a new genus attributed to Nuttall, *Styphonia*, based on *S. integrifolia* Nutt. (= *Rhus integrifolia* (Nutt.) Benth. & Hook. f.). This species had "fruit similar in most respects to that of *Rhus* § *Sumac*; inflorescence somewhat approaching that of *Lobadium*; differing from both, particularly in the gradual transition from bracts to petals." Finally, in 1917, Abrams (p. 220) validated Nuttall's *Malosma* (published by Torrey and Gray as a subgenus of *Rhus* in 1838) and segregated it from *Rhus*; later, however, he (1951, p. 51) included *Malosma* in the latter.

In the most important recent work on the American species of *Rhus* and its immediate allies, Barkley (1937) treated *Cotinus*, *Metopium*, *Rhus*, *Toxicodendron*, *Malosma*, and the earlier segregated *Actinocheita* Barkley as distinct genera. The group known as "*Schmaltzia* Desv." was emended by Barkley to include *Lobadium* Raf., *Styphonia* Nutt., *Rhoeidium* Greene, and other closely related species and was treated as a subgenus of *Rhus*. In 1940, however, apparently under the influence of Heimsch's work (1940) on wood anatomy and pollen morphology of *Rhus* and allied genera, Barkley and Reed segregated "*Schmaltzia* Desv. emend. Barkley & Reed" from *Rhus*, as a distinct genus. In contrast with the tendency toward splitting the genus, Perrier de la Bathie (1946, p. 31) included the Madagascan genus *Baronia* Baker (three species) in *Rhus* as a section.

The recognition of the generic status of *Cotinus* and *Metopium* seems to be reasonable (at least at present) and is in agreement with the view of Engler (1881), who certainly was a prominent specialist in the *Rhus* complex, as well as in Anacardiaceae in general. The segregation, however, of "*Schmaltzia*" and *Toxicodendron* as distinct genera appears questionable with regard to the characters on which this segregation has been based. These supposedly generic differences are surveyed and discussed below.

Since the extra-American subdivisions of *Rhus*, sects. *Gerontogae* Engl. and *Melanocarpace* Engl., are also involved in the discussion, it is expedient for purposes of comparison to regard them as units at the subgeneric level, rather than to compare subgenera with sections. Consequently, the nomenclatural and taxonomic classification of this complex genus as adopted in the present article is given below.

Rhus Linnaeus, Sp. Pl. 1: 265. 1753; Gen. Pl. ed. 5. 129. 1754.

Rhus subgen. *Rhus*. (LECTOTYPE SPECIES: *R. Coriaria* L.; see E. L. Greene, Leaflet Bot. Obs. Crit. 1: 114. 1905.)

Rhus sect. *Sumac* DC. Prodr. 2: 67. 1825, in part. (LECTOTYPE SPECIES: *R. Coriaria* L.²)

Rhus subgen. *Sumac* (DC.) Torr. & Gray, Fl. N. Am. 1: 217. 1838³; emend. Schneider, Illus. Handb. Laubholz. 2: 153. 1907.

Rhus sect. *Trichocarphae* Engl. Bot. Jahrb. 1: 379. 1881, in part. (LECTOTYPE SPECIES: *R. Coriaria* L.²)

Schmaltzia Desv. ex Small, Fl. Southeast. U.S. 727. 1903, in part.

Rhus subgen. *Lobadium* (Raf.) Torr. & Gray, Fl. N. Am. 1: 219. 1838.³

Lobadium Raf. Am. Monthly Mag. Crit. Rev. 4: 357. 1819. (TYPE SPECIES: *Rhus suaveolens* Ait. [*L. amentaceum* Raf. = *R. aromatica* Ait.] .)

Rhus sect. *Lobadium* (Raf.) DC. Prodr. 2: 72. 1825.

Turpinia Raf. Med. Repos. New York II. 5: 352. 1808, *nomen provisorium*.

Schmaltzia Desv. Jour. Bot. Appl. 1: 229. 1813, *nomen provisorium*.

Schmaltzia Desv. ex Small, Fl. Southeast. U.S. 727. 1903, in part. (LECTOTYPE SPECIES: *Rhus aromatica* Ait. [*Schmaltzia aromatica* (Ait.) Desv. ex Small] see E. L. Greene, Leaflet Bot. Obs. Crit. 1: 129. 1905.)

Schmaltzia Desv. [ex Small] emend. Barkley & Reed, Am. Midl. Nat. 24: 647, 672. 1940.

Rhus subgen. *Schmaltzia* Schneider, Illus. Handb. Laubholz. 2: 148. 1907; emend. Barkley, Ann. Missouri Bot. Gard. 24: 341. 1937. (LECTOTYPE SPECIES: *R. aromatica* Ait.; see Barkley, *loc. cit.*)

Rhus sect. *Trichocarphae* Engl. Bot. Jahrb. 1: 379. 1881, in part.

Rhus subgen. *Toxicodendron* (Mill.) K. Koch, Hort. Dendr. 197. 1853; emend. Schneider, Illus. Handb. Laubholz. 2: 149. 1907.

Toxicodendron Mill. Gard. Dict. Abridg. ed. 4. 1754, in part. (LECTOTYPE SPECIES: *Rhus Toxicodendron* L.; see O. Kuntze, Rev. Gen. Pl. 1: 153. 1891.)

Rhus L. sensu Small, Fl. Southeast. U.S. 726. 1903.

Rhus sect. *Sumac* DC. Prodr. 2: 67. 1825, in part.

Rhus sect. *Trichocarphae* Engl. Bot. Jahrb. 1: 379. 1881, as to *R. trichocarpha* Miq.

² In order to fix the application of all of the names involved, lectotype species have been chosen in instances in which the author of a name did not indicate the type species or in those apparent instances in which no lectotype has been designated previously.

³ When applying the Torrey and Gray (1838–1843) and Gray (Manual, eds. 1–5, 1848–1869) names for the subdivisions of the genera, one should bear in mind that these authors consistently employed the sectional mark (§) followed by a Latin name (noun) for indication of the “Divisions of the highest rank or *Subgenera*” (Gray, 1869, p. 17). The sectional mark without an accompanying name was used to mark a lesser, informal category. It is notable, and somewhat confusing, that in the English text Torrey and Gray used the word “section” both for the indication of a *subgenus* and in an informal sense, in contrast to contemporary French botanists who sometimes translated the Latin *sectio* as “sous-genre.”

Rhus sect. *Venenatae* Engl. *loc. cit.* (LECTOTYPE SPECIES: *R. Toxicodendron* L.²)

Rhus subgen. *Malosma* Nutt. ex Torr. & Gray, *Fl. N. Am.* 1: 219. 1838.³ (TYPE SPECIES: *R. laurina* Nutt. ex Torr. & Gray.)

Malosma Nutt. ex Abrams, *Fl. Los Angeles* [ed. 3.] 220. 1917.

Rhus subgen. *Thezera* (DC.) K. Koch, *Hort. Dendr.* 197. 1853.

Rhus sect. *Thezera* DC. *Prodr.* 2: 72. 1825. (LECTOTYPE SPECIES: *R. pentaphylla* (Jacq.) Desf. [*R. Thezera* Pers.].²)

Rhus sect. *Sumac* DC. *loc. cit.* 67, in part.

Rhus sect. *Gerontogae* Engl. *Bot. Jahrb.* 1: 379. 1881. (LECTOTYPE SPECIES: *R. pentaphylla* (Jacq.) Desf.²)

Searsia Barkley, *Am. Midl. Nat.* 28: 472. 1942. (Based on *Rhus* sect. *Gerontogae* Engl.)

Rhus subgen. *Melanococca* (Blume) Brizicky, *stat. nov.*

Melanococca Blume, *Mus. Bot. Lugd.-Bat.* 1: 236. 1850 (fide Engler, *Bot. Jahrb.* 1: 380. 1881, et in DC. *Monogr. Phaner.* 4: 450. 1883). (TYPE SPECIES: *M. tomentosa* Blume = *Rhus retusa* [var.] β , *Blumei* Engl. = *R. taitensis* Guill.)

Rhus sect. *Melanocarphae* Engl. *Bot. Jahrb.* 1: 380. 1881. (LECTOTYPE SPECIES: *R. taitensis* Guill.²)

Duckera Barkley, *Am. Midl. Nat.* 28: 472. 1942. (Based on *Rhus* sect. *Melanocarphae* Engl.)

Rhus and "Schmaltzia"

Barkley (1940) mentioned the following characters as basic for separation of the two genera.

RHUS	"SCHMALTZIA"
1. Inflorescence a compact, many-flowered thyrses, appearing after the leaves; each flower subtended by a lanceolate, caducous bract; bractlets wanting.	1. Inflorescence a group of spikes or less commonly a group of racemes; each flower subtended by a persistent bract and two similar bractlets.
2. Shrubs and small trees, erect; branches usually few, and rather thick.	2. Shrubs and small trees, several subsucculent; branches many, slender.
3. Resin canals absent in the wood rays, the latter from two to four cells wide.	3. Resin canals present in the wood rays in two species studied by Heimsch (1940), the rays one to two cells wide.
4. Surface of pollen grains reticulate or striate.	4. Surface of pollen grains generally smooth, striations when occurring faint and widely spaced.
5. Pubescence on fruits of red glandular hairs intermixed with deeply red-stained nonglandular hairs.	5. Pubescence on fruits of red glandular hairs intermixed with hyaline nonglandular hairs.

INFLORESCENCE. The type of inflorescence, thyrsoid in *Rhus* and usually indeterminate in *Schmaltzia*, seems to be the most conspicuous and perhaps the most important character distinguishing these groups. The latter type of inflorescence is, however, easily derivable from the former by reduction and contraction. The occurrence of "a terminal open thyrses" (and caducous bracts and bractlets) in *S. Lentii* (Kellogg) Barkley (= *Rhus Lentii* Kellogg), a species supposed to be a "primitive type" in the segregate genus, confirms the preceding statement and shows a possible connecting line between *Rhus* and *Schmaltzia*. It is notable also that minute and caducous bractlets are usually present in *Rhus*, too, although they are not easily detectable because of their small size and the complexity of the inflorescence. Even in regard to the time of flowering there is no sharp line between the two taxa, since many species of *Schmaltzia* (§§ *Pseudosumac*, *Styphonia*, and *Pseudoschmaltzia* of Barkley) possess at least coetaneous inflorescences.

The somewhat different habit, although of diagnostic value, can hardly be of generic significance.

ANATOMY. The significance of the presence or absence of resin ducts in the wood rays (if a constant character) in the taxa involved can only be determined from an extensive study of *Rhus*, *sensu lato*. The presence of resin ducts in wood rays in three of four investigated species of the Indo-African-New Guinean subgen. *Thezera* (*Rhus* § *Gerontogae* Engl.) has been recorded by Heimsch (1940). Thus this character does not seem to be constant even in that very natural group. The width of wood rays (two to four cells in *Rhus* against one to two cells in *Schmaltzia*) can hardly be considered a reliable character in *Rhus*, since in this genus it seems to be liable to variation even within a species. Thus, Kanehira (1921a, b) describes wood rays in *R. javanica* L. (*R. chinensis* Mill.) as "1-5 cells wide, 10-30 cells high" in wood from Formosa, and "1 or 2 sometimes 3 cells wide, up to 55 cells high" in specimens from Japan. Gammerman *et al.* (p. 46) characterize wood rays of *R. typhina* L. as being one or two cells wide and up to 20, more rarely 30-40, cells high. In addition, Heimsch (1942, p. 141) wrote of the anatomical evidence for the generic segregation of *Schmaltzia* that "*Schmaltzia* is too poorly represented in available wood collections to test properly the validity of this proposal from the standpoint of xylem structure."

POLLEN. Heimsch (*loc. cit.*) was, however, of the opinion that "evidence from pollen morphology supports such a change [segregation of *Schmaltzia*] [for,] pollen grains of species of *Rhus* possess a sculptured exine [reticulate or striate] in contrast to the usual smooth, unsculptured [rarely faintly striate] pollen grains of *Schmaltzia*." This statement may be objected to on at least two bases, however. First, the taxonomic value of the surface character of pollen grains in general (like the value of many other endo- and exomorphic characters) may not be assumed *a priori*

but must be accurately determined in each individual case since it may vary in different groups of affinity. This problem can hardly be solved at present since it requires not only additional and more extensive palynological data, but also data from other branches of botany, especially from floral ontogeny and biology, and ecology of the species. Second, neither Heimsch (1940, 1942) nor Barkley (1940), who applied Heimsch's data for the generic segregation of "*Schmaltzia*," has shown that reticulate, striate, faintly striate, and smooth pollen grains cannot occur within the limits of a genus. Indeed, the data compiled from Wodehouse (1935), Erdtman (1952), and Ikuse (1956) demonstrate that a situation in regard to the sculpturing of pollen grains similar to that in *Rhus* can be found in at least several very natural genera, e.g., *Rosa*, *Acer*, and *Viola*. Thus, seven species and one variety of *Rosa* listed by Ikuse (p. 91) have "fine reticulate" pollen; however, the texture of exine is striate "vaguely suggesting the markings of a fingerprint" in *R. rugosa* Thunb., *R. bracteata* Wendl., *R. centifolia* L., and *R. rubiginosa* L. (= *R. Eglantheria* L. fide Fernald), and is variously granular in *R. setigera* Michx., *R. multiflora* Thunb., and *R. Noisettiana* Thory (*R. chinensis* × *moschata*) (Wodehouse, 1935, p. 428). Pollen grains in 17 Japanese species of *Acer* listed by Ikuse (*loc. cit.*, pp. 101, 102) are "striato-fine reticulate" (in 12 species) or striate (in four species and two varieties) or spinulose (in *A. carpinifolium* Sieb. & Zucc.). According to Wodehouse's data on pollen of the same genus, the exine is distinctly striate in *A. Pseudo-Platanus* L. and *A. platanooides* L., less distinctly striate in *A. rubrum* L., extremely faintly striate, sometimes only granular, in *A. saccharum* Marsh., and smooth with a granular texture in *A. Negundo* L. (Wodehouse, *loc. cit.*, pp. 439–442). Finally, in the genus *Viola*, 30 species listed by Ikuse (pp. 106, 107) have "fine reticulate" pollen grains, but seven species mentioned by Wodehouse (*loc. cit.*, p. 443, e.g., *V. palmata* L., *V. cucullata* Ait., *V. conspersa* Reichenb.) and several Hawaiian species of *Viola* (Selling, pp. 117–120) possess a smooth, granular exine.

From the above-mentioned examples, the conclusion may be drawn that pollen grains with a reticulate, striate, faintly striate, and smooth surface may occur within the limits of a natural genus (e.g., *Rosa*, *Acer*, *Viola*) and the smoothness of pollen surface in most species of "*Schmaltzia*" may hardly be regarded as a character of generic significance. As in the genus *Acer* where the extremely faintly striate, sometimes only granular, pollen grains of *A. saccharum* are intermediate between the striate pollen of some species of *Acer* (e.g., *A. Pseudo-Platanus*, *A. rubrum*) and the smooth pollen of *A. Negundo*, the faintly striate pollen grains of some species of *Schmaltzia* § *Styphonia* (including *R. Lentii* with its thyrsoid inflorescences with caducous bracts and bractlets) may be regarded as transitional between the (finely) reticulate or striate pollen grains of *Rhus* and the usually smooth pollen of "*Schmaltzia*."

FRUIT. In fruit structure *Rhus* and "*Schmaltzia*" agree to a great extent, the exo- and mesocarp usually being permanently united and easily de-

tachable from the bony endocarp. In a few species of "*Schmaltzia*," however, the inner layers of mesocarp, striate with conspicuous resin ducts, remain attached to the stone thus simulating (always?) fruits of species of *Toxicodendron*. Even the pubescence on fruits of *Rhus* and *Schmaltzia* is of the same kind, consisting of amber-colored to reddish-brown glandular hairs with a short unicellular stalk and a multicellular, usually ellipsoidal, obovate to club-shaped head and often also of red to colorless nonglandular hairs. So, for example, the nonglandular hairs on the fruit coat are deeply red stained in *R. typhina*, *R. glabra* L. and *R. Michauxii* Sarg., but are colorless in *R. copallina* L.; on the other hand, the nonglandular pubescence on fruits of *Rhus* (*Schmaltzia*) *aromatica* consisting largely of colorless hairs always includes at least a small number of red-stained hairs.

Since the characters distinguishing *Schmaltzia* from *Rhus* do not appear to be of generic significance, and apparent transitions between these groups in inflorescence type (*S. Lentii*) and sculpture of pollen grains (*Schmaltzia* § *Styphonia*) do occur, a close relationship between these groups so clearly displayed in the similar flower and fruit structures can be best expressed by considering *Schmaltzia*, under its correct name *Lobadium* Raf., a subgenus of *Rhus*.

Rhus and Toxicodendron

The following characters are usually considered to be of importance for separation of these groups as distinct genera.

RHUS	TOXICODENDRON
1. Inflorescences terminal thyrses.	1. Inflorescences axillary panicles.
2. Fruits reddish or red, always glandular-pubescent; exocarp and nonwaxy mesocarp permanently united and separating from the smooth stone.	2. Fruits greenish or yellowish white to dun colored, never glandular-pubescent; exocarp fragile, breaking and exposing waxy mesocarp remaining attached to the usually \pm ribbed stone.
3. Resin nonpoisonous.	3. Resin consistently poisonous.
4. High content of tannins.	4. Low content of tannins.
5. Vessels clustered in late wood; resin ducts present in the wood rays of some species; septate wood fibers absent.	5. Vessels not clustered in late wood; resin ducts absent in the wood rays; septate wood fibers present.
6. Pollen grains ellipsoidal, the longer axis 31–43 μ long.	6. Pollen grains spherical, about 29 μ in diameter.
7. Root hairs tawny pink or lighter (Gillis, 1961).	7. Roots hairs dark brown in American species (Gillis, 1961).

INFLORESCENCE. There is no basic difference in the type of inflorescence between the two groups. The "panicles" of *Toxicodendron* are thyrses (although sometimes considerably reduced and appearing almost racemose)

as has already been stated by Copeland and Doyel (p. 933) for *Rhus* (*Toxicodendron*) *diversiloba* T. & G. The taxonomic significance of the terminal or axillary position of these inflorescences is obscure and seems to decrease in value when the distribution of this character within *Rhus* as a whole is taken into consideration. Thus, although terminal inflorescences seem to be the rule in subgen. *Rhus*, in *R. Coriaria* additional inflorescences sometimes develop in the axils of the upper two to six leaves (e.g., in a few specimens seen from Iraq, Palestine, and the USSR [A, GH]). The occurrence of terminal and/or axillary inflorescences in subgen. *Lobadium* has already been mentioned (see Jour. Arnold Arb. 43: 371. 1962). In South African species of the very extensive subgen. *Thezera*, mostly both terminal and axillary inflorescences occur within a species. However, in some (e.g., *R. tomentosa* L., *R. incisa* L. f., *R. Keetii* Schonl.) terminal inflorescences, in others (e.g., *R. horrida* Eckl. & Zeyh., *R. natalensis* Bernh., *R. albomarginata* Sond.) axillary inflorescences seem to be constant. In *R. Legatii* Schonl., staminate and carpellate plants differ in this respect, the former usually bearing terminal, the latter mostly axillary inflorescences (Schonland, p. 51).

In *Rhus taitensis*, of the southwestern Pacific subgen. *Melanococca* (*Rhus* § *Melanocarpace*), terminal inflorescences, sometimes accompanied by a few additional axillary inflorescences in the axils of the upper leaves, are most usual. However, in some specimens from Fiji (e.g., *A. C. Smith* 6792 [A], *Gillespie* 4167 [GH]) only axillary inflorescences have been seen. Also, the original description of *R. simarubifolia* A. Gray (usually included in *R. taitensis*) notes, "Panicles axillary, rather shorter than the leaf, loosely flowered" (Gray, 1854, p. 368). Gibbs (p. 144), too, characterized the latter species as "A very handsome tree, 17 m. high, with white trunk and flat crown. The erect, axillary racemes of white flowers are very freely produced, and stand well above the pinnate leaves." It is possible that in *R. taitensis* terminal or axillary inflorescences can occur on different branches of the same plant, since *Gillespie* 4162 (GH) from Fiji is represented by two branchlets, one with a single axillary inflorescence, the other with a terminal infructescence.

Although in *Toxicodendron* the axillary inflorescences seem to be fixed (the occurrence of axillary and terminal inflorescences in *R. perakensis* Scortechini ex King, mentioned by King (p. 500), should, however, be checked), this good diagnostic character alone can only be regarded as of questionably generic significance in view of the distribution of axillary inflorescences within the genus *Rhus* as a whole.

FRUITS. The fruits of *Toxicodendron* are said to differ essentially from those of *Rhus* in their color; in the lack of glandular pubescence on the fruit coat; in the exocarp separating from the mesocarp; and in the waxy mesocarp adherent to the usually \pm ribbed stone. The color of fruits varies in *Toxicodendron* from greenish- or yellowish-white to tan. However, in *Rhus*, *sensu stricto*, the color of the fruit coat is not always red or reddish as could be assumed from descriptions which indicate a

visual effect of the red or reddish nonglandular pubescence covering the fruit, rather than the color of exocarp. The exocarp varies in the species of subgen. *Rhus* (and subgen. *Lobadium*) from red or orange (e.g., *R. glabra*, *R. Michauxii*) to different shades of brown (e.g., *R. Coriaria*, *R. copallina*, *R. javanica*, *R. punjabensis* Brandis, thus overlapping some species of *Toxicodendron* with brown fruits (e.g., *R. Griffithii* Hook. f.). It is also notable that the field data accompanying the specimen *Purseglove 4440* (A) of *Rhus* (*Toxicodendron*) *perakensis* from Borneo indicate "fruits red drying glossy buff." Although color of the fruit may be regarded as a good diagnostic character on the specific level, it can hardly be useful for distinguishing larger groups because of its variation within the subdivisions and the degree of overlap.

The glandular pubescence on the fruit coat, consisting of amber-colored to reddish-brown hairs with a short unicellular stalk and multi-cellular head, is quite characteristic of the subgenera *Rhus* and *Lobadium* (in which it also occurs on the other parts of the plant body), and does not occur on fruits in *Toxicodendron* or in the subgenera *Thezera* and *Melanococca*. It is notable, however, that morphologically similar, but minute, hairs have been recorded by McNair (1921, p. 137, *pl. 2, F*) in *R.* (*Toxicodendron*) *diversiloba* where "they are found mostly on the young rapidly growing organs of the plant, especially on the floral region and the leaves, less on the green stems and hardly at all on the woody portions." Copeland and Doyel (p. 934) observed such hairs also on the ovaries of the same species. Möbius (p. 213, *fig. 7. III*) described and illustrated a similar glandular hair from the leaf of *R.* (*Toxicodendron*) *verniciflua* Stokes ("*R. vernicifera* DC."). In South African species of subgen. *Thezera*, where the glandular pubescence of the vegetative organs reaches the maximum of its morphological diversity and complexity within *Rhus*, species with transitory or persistent glandular pubescence are known. However, glandular-pubescent ovaries (but glabrous fruits) have been recorded only in *R. Steingroeveri* Engl. (Diels, p. 592). From this brief and superficial survey one may conclude that, although the taxonomic significance of glandular pubescence on fruits of species of the subgenera *Rhus* and *Lobadium* cannot be evaluated at present, this character appears to be of a certain diagnostic value.⁴

⁴The diagnostic value at the specific level seems to be evident from the following examples based on the author's observations and some data from the literature on the morphology of nonglandular, uniseriate, "acid" hairs which cover fruits in *Rhus glabra*, *R. Michauxii*, *R. typhina*, and *R. × pulvinata* Greene (including *R. glabra* var. *borealis* Britt.). These hairs are of the same morphological structure in *R. glabra* and *R. Michauxii*, being 3-several-celled, about 0.3 mm. long, stout, usually club shaped or elliptical, rounded at the top (cf. Barkley, 1938, p. 600, *fig. 2a*; Gleason, p. 497, *fig. ref. to R. glabra*). The homologous hairs in *R. typhina* are several-celled, about 2-3 mm. long, fine, gradually tapering to a usually sharp point (cf. Barkley, 1938, p. 600, *fig. 2d*; Gleason, p. 497, *fig. ref. to R. typhina*). In his treatment of *Rhus*, Barkley (1937, p. 326) stated concerning its relationships, "*Rhus Michauxii* is a very distinct species whose closest affinities seem to be with *R. javanica* L. and *R. Coriaria* L. of Asia and Europe." However, the occurrence of morphologically similar hairs in both *R. Michauxii* and *R. glabra* seems to speak for a closer relationship of the former with

Fruit histology seems to be basically the same in all the subdivisions of *Rhus*. The exocarp is always formed by a single cell layer. The mesocarp is predominantly parenchymatous or parenchymatous throughout and is traversed by vascular bundles usually accompanied with resin ducts. The endocarp is usually hard, composed of four cell layers: an outermost parenchymatous, crystal-bearing layer, followed by the three layers of radially oriented columnar sclereids the innermost layer of which consists of the longest and the middle layer of the shortest cells (Möbius, pp. 239–242, *fig. 29*, for *R. verniciflua*; Copeland & Doyel, pp. 936, 937, *figs. 38, 39*, for *R. diversiloba*).

While the histological structure of the endocarp seems to be almost invariably the same in all the subdivisions of *Rhus*, that of the mesocarp appears to be somewhat different, not only in the representatives of different subdivisions, but also in the species belonging to the same group. Thus, the mesocarp in *R. Coriaria* has been described (Reboul, pp. 39, 40) as parenchymatous throughout and only slightly heterogeneous, its layers adjacent to the endocarp being composed of cells differing only in the brightness of their walls (“à parois mince et très claires”) from those forming the bulk of mesocarp and having the cell walls very refringent (“à parois minces et très refringentes”). In *R. glabra*, however, the two zones of the mesocarp are sharply defined; the inner zone (adjacent to the endocarp) differs from the outer in its yellowish color, greater fragility, and presence of “small stone cells” (Youngken, p. 530). This difference between the two zones of mesocarp is so well marked that Youngken (*loc. cit.*) apparently mistook the inner zone of the latter for the endocarp, regarding the true endocarp as a “very hard” seed coat. In some species of *Toxicodendron* (e.g., *R. diversiloba*, *R. radicans* L., *R. Vernix* L.) the parenchymatous mesocarp seems to be homogeneous, consisting of cells filled with “wax,” while in other species (e.g., *R. Griffithii*, *R. insignis* Hook. f.) the outer layers of parenchyma differ from the inner in the absence of “wax” in their cells. In *R. verniciflua* (Möbius, p. 240), and probably in all the other species of *Toxicodendron*, the two or three innermost layers of mesocarp are formed by small, roundish sclereids (cf. *R. glabra*, above). Apparently the histological peculiarities of the fruits in *Rhus*, *sensu lato*, are responsible for the fruit characters on which Engler based his sections of *Rhus*. Thus, the fruits of sect. *Trichocarphae* Engl.

the latter, rather than with the species “of Asia and Europe,” which have hairs morphologically different from those of both American species. The occurrence of a fertile, putative hybrid between *R. Michauxii* and *R. glabra* (cf. Ashe, p. 581, “ \times *Schmaltzia Ashei*”) seems to confirm the evidence from the morphology of hairs. Rollins (1944) showed in the case of hybrids between *Parthenium argentatum* A. Gray and *P. incanum* A. Gray that evidence from the morphology of trichomes can present “the primary basis for determination of the hybrids” (p. 98). This seems to be applicable also to the hybrids between *Rhus glabra* and *R. typhina*, “cigar-shaped” hairs on the fruit coats of which appear to be intermediate in their shape and size between those of the supposed parents (cf. Barkley, 1938, pp. 598, 600 *figs. 2b, 2c*). The examples mentioned above demonstrate the probable taxonomic importance of the hair covering in *Rhus* and suggest a careful study of the morphology of hairs in the genus.

(i.e., subgenera *Rhus* and *Lobadium*) have been described as having "Exocarp und Mesocarp bei der Reife im Zusammenhang bleibend und sich vom Endocarp loslösend," while in the sect. *Venenatae*, i.e., *Toxicodendron*, "Das Exocarp bei der Reife sich ablösend . . . Mesocarp dem dicken Endocarp anhängend" (Engler, 1881, p. 379). These characters, however, do not have a general validity either in Engler's *Trichocarpaceae* or in *Venenatae*. Although in most species of the subgenera *Rhus* and *Lobadium* the exocarp and mesocarp are permanently united and easily separable as a whole from the endocarp, in *R. glabra* only the outer reddish-green zone of mesocarp remains permanently united with the exocarp and separates from the inner yellowish zone which, in turn, detaches easily from the endocarp. Also, in some species of *Lobadium* (e.g., *R. aromatica*, *R. trilobata* Nutt.) and *Toxicodendron* (e.g., *R. Griffithii*, *R. insignis*) the outermost layers of mesocarp are permanently united with exocarp and separate themselves from the bulk of the mesocarp (filled with "wax" in the latter group) which remains attached to the stone. In other species of *Toxicodendron* (e.g., *R. diversiloba*, *R. radicans*, *R. Vernix*), the exocarp alone separates from the uniformly "waxy" parenchymatous mesocarp. Probably the situation in respect to the fruit characters, similar to that of most species of subgen. *Rhus* (e.g., *R. Coriaria*, *R. typhina*) exists in subgen. *Melanococca* (*Rhus* § *Melanocarpaceae*), that of *Toxicodendron* in the species of the subgen. *Thezera* (*Rhus* § *Gerontogeeae*).

The character of the stone surface, smooth in subgenera *Rhus* and *Lobadium* and \pm ribbed or bumpy in *Toxicodendron*, may be applied as a diagnostic feature only to a limited degree, since the stones in some Asiatic species of the latter (e.g., *R. verniciflua*) are smooth.

This brief survey of the fruit characters shows that the mode of connection and/or separation of the fleshy parts of the pericarp from each other and from the endocarp can hardly be regarded as a reliable differential feature of the subdivisions of *Rhus*; however, knowledge of fruit histology, very fragmentary and inadequate at present, may perhaps be of primary importance for distinguishing the subdivisions and for solution of the problem of their relationships.

CHEMISTRY. The "wax" which occurs within the cells of the mesocarp in *Toxicodendron* and *Rhus* (*Malosma*) *laurina* is a solid fat (tallow) composed of glycerides of fatty acids, mainly of palmitin (in larger amounts) and olein (in smaller amounts); also a small percentage of one or two free, dibasic, high-molecular fatty acids has been found in fat of all the species investigated, except *R. trichocarpha* Miq. (Wehmer, 1911, 450-453; 1935, p. 175; Merck Index, p. 550). The iodine value of this fat varies from 4 to 17 (Long, King & Sperry, p. 988). In contrast to the mesocarp, the seeds contain a semiliquid oil (Wehmer, 1935, p. 175, for *R. succedanea* L.). Unfortunately, only a few incomplete data on the fruit chemistry of the species of subgen. *Rhus* (and none for those of subgenera *Lobadium*, *Thezera*, and *Melanococca*) have been available. Thus Reboul (p. 50) says about the oil which in the form of droplets fills the

cells of the mesocarp and of the seed in *R. Coriaria*, "L'huile de *Rhus coriaria* est composée surtout par 75% d'acide oleique et par 25% d'acides gras solides, appelés industriellement stéarines, formée surtout par l'acide palmitique." The iodine value of this oil (unfortunately a mixture of oils of both the seeds and the mesocarp) is given by Reboul (*loc. cit.*, p. 52) as 83.06. Millspaugh (p. 36-4) mentions the "oil of *Rhus*" saying, "This waxy oil may be extracted from the seeds [fruits?] of this [*Rhus glabra*] and other species of the genus. It will acquire a tallow-like consistence on standing, and can be made into candles, which burn brilliantly, but emit a very annoying pungent smoke." Wiesner (p. 715) in his brief description of the same oil points out a difference between the oil of seeds and mesocarp (?) of fruits saying, "Rhusöl wurde aus den enthülsten Samen von *R. glabra* in einer Ausbeute von 9% erhalten. Es war ein angenehm schmeckendes, eigenartig riechendes, hellgelbes Öl. Auch aus den Samenschalen [mesocarp?] wurde etwas die gleiche Menge Öl gewonnen, das bei gewöhnlicher Temperatur halbfest war." Finally, McNair (1930, p. 49) gives some data on chemical and physical properties of the oil from "kernels" [seeds] of *R. glabra*. This oil belongs to the group of semidrying oils, having an iodine value of 126.9. The big difference between the iodine value of the oil of fruits in *R. Coriaria* (given by Reboul) and that of the oil of seeds in *R. glabra* is notable, but this difference apparently is due to the fact that the iodine value of the oil in the former pertains to the mixture of oils from seeds and mesocarp.

It is known, however, that the fats and/or oils from seeds and mesocarp may be quite different (McNair, 1930, pp. 48, 49; Steele, p. 38), e.g., *Oenocarpus* (Palmae) and *Sapium* (Euphorbiaceae) with oil in seeds, but a solid fat in mesocarp. McNair's survey (1930, pp. 64-68) of the distribution of fats and oils in seeds of the families of the Angiosperms shows that, although in some cases one kind of oil (classified as drying, semidrying, or nondrying) or fat can be characteristic for a subfamily, tribe, or genus, there also are genera in which the species differ in this respect: e.g., seeds with nondrying oil or with a solid fat occur in species of *Coula* (Olacaceae), *Canarium* (Burseraceae), *Polygala* (Polygalaceae), while seeds with semidrying oil or with a solid fat can be found in species of *Laurus* (Lauraceae) and *Luffa* (Cucurbitaceae). Apparently, similar or perhaps more variable conditions can be expected in regard to the distribution of oils and fats in the mesocarp of fruits in the Angiosperms. Although the chemical nature of fats and oils occurring in seeds and mesocarp of the species of the *Rhus* complex may certainly be of taxonomic importance as are many other biochemical characters, the taxonomic significance of this feature cannot be evaluated at present because of lack of adequate and comparable data. We even may hardly assert that solid fat is completely absent from subgenera *Rhus* and *Lobadium*, as well as *Thezera* and *Melanococca*.

A resin constantly poisonous because of the presence of toxic catechols (Gillis, 1961, p. 30) has been assumed to be one of the most distinguishing features of *Toxicodendron* in contrast to the nonpoisonous resin of all

the other groups of *Rhus*. Four poisonous substances identified "as variations in saturation of the alkyl side chain in 3-*n*-pentadecylcatechol" have been found in *Rhus* (*Toxicodendron*) *radicans* L. "The Japanese lac tree (*T. vernicifera*) differs in poison chemistry in only one of the four poisons. . . . There is some evidence that the chemistry of the poisons in poison sumac is different from that of poison ivy" (Gillis, *loc. cit.*). While the resin of the species of *Toxicodendron* has been the subject of frequent and thorough investigations for at least several decades, there are no data available concerning the chemical nature of the resin in any of the other groups of *Rhus*. Therefore, no conclusions can be drawn on the degree of chemical relationship of the resins in the groups involved or on the taxonomic significance of this character. It is notable, however, that *R. punjabensis* Steward ex Brandis (subgen. *Rhus*) is still regarded as very poisonous. "The juice of this tree is corrosive and vesicant. For this reason it is not cut or hacked wantonly" (Chopra, Badhwar & Ghosh, 1949, p. 322).

The difference between *Rhus* and *Toxicodendron* in tannin content, high in the former and low in the latter, is hardly of any taxonomic significance, being of a quantitative nature only. Moreover, the leaves in *R. (Toxicodendron) succedanea* contain about 20 per cent of tannin (Chopra, Badhwar & Ghosh, p. 323).

WOOD ANATOMY. The wood anatomical evidence often quoted in support of the generic segregation of *Toxicodendron* from *Rhus* does not seem to be unequivocal. There is no comprehensive comparative anatomical monograph of the *Rhus* complex, and the two excellent, but brief and rather general, wood anatomical surveys of Heimsch (1940, 1942) do not include some important characters (e.g., nodal anatomy⁵) nor provide data on possible variations and correlations of the anatomical characters within the genera of Rhoëae (Rhoideae). Therefore, the evaluation of these characters is difficult, and the significance can easily be overestimated.

⁵ Since the above was written, Dr. Richard A. Howard, to whom I am most grateful, has given the use of his data on six species of *Rhus* which have been investigated by him in the course of a survey of petiolar anatomy. All of these species have a trilacunar node. *Rhus* (*Lobadium*) *ovata*, a simple-leaved species, has a vascular pattern which is found in many types of simple leaves and differs from that found in dissected or compound leaves of the other species. No secondary tissue was developed from the cambium in this species. In two trifoliolate species, *R. (Lobadium) aromatica* and *R. (Toxicodendron) Toxicodendron*, the median trace contributes to the vascular supply of the terminal and lateral portions of the blade. In three pinnately multifoliolate species of subgenus *Rhus* (*R. copallina*, *R. glabra*, and *R. typhina*) the median trace does not contribute to the vascular supply of the leaflets of the lower third of the blade, these being supplied only by the two lateral traces. Both the lateral and median traces contribute to the supply of the upper leaflets, the median alone seeming to vascularize the terminal segment. The amount of secondary tissue in species with trifoliolate or pinnate leaves varied with the size of the leaf. Two characteristics distinguish these species of *Rhus* from other anacardiaceous genera studied: the median and the two lateral traces all quickly divide into three parts, and resin canals (present in the stem cortex) are missing from the lower pulvinus and redevelop in the petiole.

Thus, the presence or absence of vessel clusters in wood of the taxa involved can hardly be regarded as an indisputable generic character.

This is quite evident from a summary of pertinent anatomical features of the genera of Lauraceae, given by Stern (pp. 18, 19). Although most of the genera of this family have some percentage of clustered vessels which is liable to considerable variation within a genus (e.g., *Aniba Kappleri*, 6 per cent; *A. ovalifolia*, 1 per cent; *Sassafras albidum*, 1 per cent; *S. Tsumu*, 7 per cent), there are also genera in which species with clustered or with nonclustered vessels do occur (e.g., *Lindera communis*, 1 per cent of clustered vessels; *L. Benzoin*, no clustered vessels; *Eusideroxylon Melangangai*, 20 per cent of clustered vessels; *E. Zwageri*, no clusters). Perhaps the pattern of vessel arrangement has a different value in Anacardiaceae, but there are no detailed data available to test this.

It is notable, however, that at least in *Rhus* (*Malosma*) *laurina* the pattern of vessel arrangement seems to be liable to variation. Thus, although the vessels in the diffuse-porous wood of this species are usually solitary or in short multiples, "one specimen, however, showed longer radial multiples with frequent clusters" (Heimsch, 1940, p. 280). Although the absence of vessel clusters in wood of *Toxicodendron* and the presence of such in the species of the subgenera *Rhus* and *Lobadium* appears to be a good diagnostic feature, especially in the limits of a regional flora, there are no reasons at present to generalize this character, ascribing to it a generic significance.

The occurrence of resin ducts in the wood rays of some species of subgenera *Lobadium* and *Thezera* and the absence of these in the species of *Toxicodendron* may hardly be quoted in support of segregation of the latter from *Rhus*, since all the species of subgen. *Rhus* also lack such resin ducts.

The occurrence of septate wood fibers in the secondary wood of Angiosperms is generally considered to be a good diagnostic feature, but the significance of this character apparently varies in different families and genera. Thus, septate wood fibers have been found by Heimsch (1942, pp. 122, 123) in all the material of Burseraceae investigated by him (40 species in 19 genera), except two apparently misidentified specimens of two species of *Canarium*. However, septate fibers have not been found in wood of *Commiphora Holziana* (Metcalf & Chalk, p. 458) of this family. In Simaroubaceae septate wood fibers are common only in *Alvaradoa* and *Kirkia*, occurring sporadically in *Ailanthus malabarica*, two species of *Soulamea*, in *Suriana*, *Guilfoylia*, and in *Picramnia*.

In the tribe Anacardieae ("Mangifereae") of Anacardiaceae septate wood fibers have been recorded by Heimsch (1942) only in *Buchanania*; however, such fibers have been found "äusserst spärlich, zwischen den einfachen [Libriformfasern] zerstreut" by Janssonius (Moll & Janssonius, pp. 440, 462) in *Mangifera indica* L. and a few other species of *Mangifera* from Java. In the tribe Spondieae septate fibers have been recorded in all the genera; in Rhoëae ("Rhoideae") in about 60 species in 20 genera (of the total 93 species in 30 genera) of this tribe investigated by Heimsch

(1942, pp. 139, 140). The occurrence of varying numbers of septate wood fibers in the wood of *Metopium* and *Toxicodendron* has been mentioned by Record (1939, pp. 29 & 45 respectively) and Heimsch (1940, p. 282); the latter also found such fibers in three of four species of *Rhus* subgen. *Thezera* (*Rhus* § *Gerontogae*) investigated. Since the species of the latter group apparently can differ in regard to the occurrence of septate wood fibers, the question arises whether it cannot be the same in the species of *Toxicodendron*. Thus, Kanehira (1921a, p. 86; 1961b, pp. 20, 21) did not mention the occurrence of septate wood fibers either in *R.* (*Toxicodendron*) *succedanea* or in *R.* (*Toxicodendron*) *verniciflua* and did not include *Rhus* (*Toxicodendron*) in his list of the genera in which such fibers occur (1921a, p. 288). Since only a relatively small number of species of *Rhus*, *sensu lato*, have been investigated in regard to their wood anatomy and the constancy of the occurrence of septate wood fibers in *Toxicodendron* and *Rhus* (*Thezera*) is not unquestionable, the taxonomic significance of this character remains obscure at present.

This discussion of the wood anatomical evidence for a generic segregation of *Toxicodendron* from *Rhus* shows that the differential wood anatomical characters constituting the evidence, although they may have a certain diagnostic value, at present appear inconclusive for the solution of the problem.

POLLEN. The difference between *Rhus* and *Toxicodendron* in shape and size of the pollen grains is sometimes quoted in support of the generic segregation of the latter. Thus, the pollen in *Toxicodendron* is mentioned as spherical, in contrast to ellipsoidal grains in *Rhus*. This antithesis, however, hardly has a real basis. According to Heimsch (1940, pp. 284, 285), the pollen grains of four Asiatic species and all but one of the American species investigated by him were spherical. The only exception was the largely Central and South American *R. striata* Ruiz & Pavon on which Heimsch comments, "*Toxicodendron striata*, the tropical species of the genus, possesses pollen which is from 4 to 8 μ larger than pollen of the other species. Grains are also elliptical, whereas the grains of the other species are spherical." However, some other data speak against such a general statement regarding the spherical shape of pollen grains in *Toxicodendron*. Concerning the pollen grains of *Rhus* (*Toxicodendron*) *diversiloba*, McNair (1921b, p. 189) says, "The fresh pollen grains of *Rhus diversiloba* are ellipsoidal with a width $\frac{1}{3}$ to $\frac{1}{2}$ the length . . . When the pollen grains are immersed in $N/4KOH$ they assume a spherical form." Also the data supplied by Ikuse (p. 100) for three species of *Toxicodendron* indicate that, although the pollen grains in *R. verniciflua* are spherical, those in *R. ambigua* Lavallée ex Dippel (*R. orientalis* (Greene) Schneider) and *R. sylvestris* Sieb. & Zucc. are at least subspheroidal (prolate-spheroidal). On the other hand, the shapes of pollen grains in subgen. *Rhus* varies from ellipsoidal (Heimsch, 1940, p. 284 "elliptical"; Wodehouse, p. 332, for *R. glabra*) to subspheroidal or spheroidal (Wodehouse, *loc. cit.*, p. 333, for *R. typhina*). The size of

pollen grains varies from 26 μ to 43 (53) μ in subgen. *Rhus* (the grains averaging 26 μ are cited by Oszast, p. 28, for *R. Coriaria*), and from 27 μ to 35 (37) μ in *Toxicodendron*. The size apparently varies to some degree also within the limits of a species, since the pollen grains in *Rhus (Toxicodendron) verniciflua* are cited as being 27–28 $\mu \times 27$ –28 μ by Ikuse (p. 100), and 33 μ (average) by Oszast (p. 128), those in *R. typhina* have been recorded as 37.5–39 μ by Wodehouse (1932, p. 333), and 53 $\mu \times 35 \mu$ by Erdtman (1943, p. 66). Overlaps in the shape and size of pollen grains in *Rhus* and *Toxicodendron* make these characters taxonomically insignificant.

ROOT HAIRS. The different colors of root hairs, “generally tawny pink or lighter” in *Rhus* in contrast to the “dark brown root hairs” in North American species of *Toxicodendron* (Gillis, 1960, p. 28) perhaps is a good diagnostic character (if proved constant). Its taxonomic significance, however, remains obscure.

Since *Rhus* and *Toxicodendron* essentially agree in the type of inflorescence and the structure of flowers and fruits, the differential characters of the latter (axillary position of the thyrses, absence of glandular hairs on fruits with “waxy” mesocarp, lack [constant?] of vessel clustering in the late wood and presence [constant?] of varying amounts of septate fibers, and, finally, poisonous properties of resin) being of at least obscure taxonomic significance, it seems preferable at present to treat *Toxicodendron* as a subgenus of *Rhus*.

LOBADIUM RAFINESQUE VERSUS SCHMALTZIA DESVAUX

In 1808, an article by Rafinesque appeared in which he made known his intention to publish his “Nova Genera and Species Plantarum Boreali-Americanorum.” According to him this work would contain “accurate descriptions and histories of all the new genuses and species of plants discovered in the United States of America, and published since Linnaeus, as well as those which though mentioned by that great author, were by him badly described . . . Besides a variety of others, I shall re-establish in this work about thirty new genuses, from plants already mentioned in authors; but which I have, by observation, found to disagree sufficiently from the genuses where they were placed, to oblige me to separate them for the advantage of the science.” Among thirty genera to be segregated, Rafinesque mentioned (p. 352) “*Turpinia (pubescens and glabra)*, *Rhus aromaticum* and *suaveolens* Wild. and Mich. [sic].” A genus published in this way may not be considered validly published, and the name is to be regarded as a *nomen provisorium*. In 1813, Desvaux (p. 229) proposed *Schmaltzia* as a new name for *Turpinia* of Rafinesque, the name being pre-occupied, saying, “Si M. Rafinesque Schmaltz a réellement observé dans le *Rhus aromaticus* et *suaveolens* des caractères suffisant pour en constituer un genre, et qu’il a nommé *Turpinia* dans le *Medical Repertory* de

New-Yorck, et dont j'ai donné un aperçu il y a long-temps; alors il faudra changer ce nom, et je propose celui de *Schmaltzia*." Thus *Schmaltzia*, a new name for an invalidly published genus, is a *nomen provisorium*.

In 1819, Rafinesque described the genus *Lobadium*, based on *Rhus aromatica* and *R. suaveolens*, and this genus was validly published. Torrey and Gray (1838) and Gray (1848–1868) apparently did not accept the name *Schmaltzia* Desv. since they established the subgenus *Lobadium* (Raf.) of *Rhus*. Somewhat later, however, some botanists, especially the American, used the invalid name *Schmaltzia* Desv. instead of the correct *Lobadium*. Small (1903) apparently was the first to validate *Schmaltzia* Desv., providing it with a formal description, but including in this genus not only the species of *Lobadium* Raf., but also all the American species of *Rhus* proper (sumacs), leaving in *Rhus* only the species of subgen. *Toxicodendron*. However, even the validated *Schmaltzia* Desv. ex Small remains illegitimate, being a superfluous name for the earlier *Lobadium*, and presumably (from Small's taxonomic circumscription) including the type species of *Rhus* (*R. Coriaria*). Greene (1905) and Small in his later publications (1913, 1933) applied *Schmaltzia* in a limited sense to the species of *Lobadium* Raf. Finally, in 1940, Barkley and Reed reestablished the genus *Schmaltzia* Desv. [ex Small] and emended it to include the species of *Styphonia* Nutt. and *Rhoeidium* Greene, as well as several species previously included in *Rhus*. All the new combinations made by Barkley (1940) under *Schmaltzia* are illegitimate, and the species have to be transferred either to *Rhus* or to *Lobadium* (for those botanists who interpret it as a separate genus).

CONCLUSIONS

Having reviewed the situation concerning the delimitation of *Rhus*, the author has reached the following conclusions:

1) Our knowledge of the genus *Rhus* as a whole in regard to the internal and some external characters (e.g., pubescence) is very incomplete. The wood-anatomical and palynological data, although more numerous than those from other fields, still are inadequate and cannot be evaluated taxonomically at present. Only a few, often fragmentary, data on fruit histology, biochemistry, embryology, and cytology and none on floral anatomy, populations, and genetics have been available. More or less careful attention to the morphology of nonglandular and glandular hairs which occur on the vegetative, and sometimes on the reproductive, organs of *Rhus* apparently has been given only by Diels (pp. 592–594, 596, *pl.* 14) in his study on the adaptive evolution of the vegetative organs in the South African species of the subgen. *Thezera* (*Rhus* § *Gerontogaeae*). The data on hair morphology for the species of the other subdivisions of *Rhus* are scanty and have not been applied to the taxonomy of the genus. However, the morphology of hairs may apparently be of considerable taxonomic importance, at least in subgen. *Rhus*, serving not only for

distinguishing the species but also as a criterion of interspecific relationships and an evidence for natural hybridity.

2) Of the countries where at least two or three subdivisions of *Rhus* occur and which, therefore, seem to be of importance for the study of intrageneric relationships, only North America seems to have been adequately explored, the species occurring here having been revised more or less recently. No recent revision of the species of Asia, Malaysia, and New Guinea has been available. New Guinea, a very insufficiently explored island, seems to be of special interest, since here the subdivisions *Toxicodendron* (*R. lamprocarpa* Merr. & Perry), *Melanococca* (*R. taitensis* Guill.), and *Thezera* (*R. lenticellosa* Lauterb., *R. caudata* Lauterb., and *R. linguata* Slis) meet. Not only is the very disjunct extension of *Thezera* from its continental Indo-African range remarkable, but equally so is the circumstance that the New Guinean species of this section differ from the continental species in some perhaps essential characters. (Unfortunately, no herbarium material of the New Guinean species has been available, and the citations are taken from the specific descriptions and notes of Lauterbach (1910, 1920) and Slis (1924). While the continental species of *Thezera* possess almost exclusively 3-foliolate, rarely palmately 5-7-foliolate (never pinnate) leaves and non- or indistinctly fibrous mesocarp and are nonscandent shrubs or trees, *R. lenticellosa* has been described as a scandent shrub with trifoliolate, unifoliolate or pinnately 5-foliolate leaves and "fibrous" mesocarp; and *R. caudata* is characterized as a small tree or perhaps sometimes an "armdicke Liane" (Lauterbach, 1920, p. 362, note to *Ledermann 12132*) with pinnate, 5-7-foliolate leaves. These differential characters of the New Guinean species seem to suggest a greater similarity in morphology and biology between the subgenera *Thezera* and *Toxicodendron* than that exhibited by the continental species of the former section. Hence, study of the full diversity of the species of the genus might prove to be very helpful for the determination of the intrageneric (as well as intergeneric) relationships and should precede any decisions on generic segregation, especially in the cases where the taxonomic significance of many differential characters appears to be uncertain.

3) Although the interpretation of *Toxicodendron*, *Lobadium*, etc., as subgenera of *Rhus* or as separate genera is a matter of personal evaluation and opinion, the former interpretation seems to be preferable as a provisional classification (until the accumulation of more adequate data on the species of the groups involved makes possible a solution of the problem of the taxonomic status of these subdivisions) for the following reasons:

a) Both close relationships and a considerable individuality are stressed by granting subgeneric rank to these groups.

b) A subgeneric status does not require creation of new combinations (except a few transfers from "*Schmaltzia*," which have to be made in any case) and a consequent overflow of synonyms in the event that some rearrangement of the groups or a change in their subgeneric rank (e.g.,

Lobadium to a section of subgen. *Rhus*, or *Thezera* to a section of subgen. *Toxicodendron*) may be found necessary by some taxonomists.

4) In the application of the older generic names to the new or reestablished generic segregates, the International Code should be followed strictly, and generic names must first be checked in regard to their validity. Failure to do this has resulted in a profusion of invalid generic names and binomials in the American botanical literature (e.g., "*Schmaltzia* Desv.," "*Malosma* (Nutt.) Engl.").

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